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ABSTRACT

This brochure, one in a series of four, is designed to assist people working in schools and in the community as they work together to encourage girls in mathematics, science, and engineering. Six sections discuss the reasons for and ways to work together to make changes. The first section describes what special programs can offer schools, and reciprocally, what schools offer special programs. The second section offers a rationale for making changes that will attract more women into mathematics and science related fields. The third section provides seven suggestions, based on evaluation and research, that help make collaboration work, and identifies five practices that, based on experience, should not be done. The fourth section presents a model that has enabled teachers to double the amount of hands-on science done in the classroom while retaining understanding. The final two sections suggest changes that need to be made in present classrooms. The suggestions include the need to: (1) make mathematics and science more of a hands-on experience; (2) provide girls with their fair share of time, attention, leadership, and opportunities in science and mathematics classrooms; and (3) challenge the stereotypes about what mathematicians and scientists are like. Resources include a list of seven successful projects whose goals involve increasing the participation of girls in mathematics and science. (MDH)

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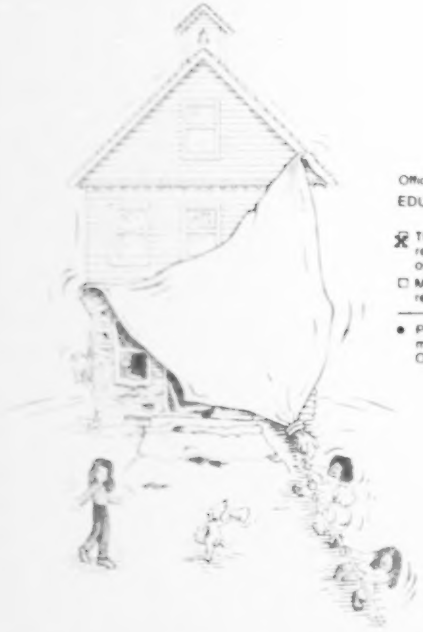
Working Together; Making Changes

Working in and out of School to Encourage Girls in Math and Science

Patricia B. Campbell, Ph.D.



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Working Together: Why Bother?

This brochure is designed to assist people working in schools and in the community as they work together to encourage girls in math, science, and engineering.

Separately, schools and special programs are limited; working together, they can change girls' lives.

Special programs can offer schools

Knowledge of how to design and carry out programs that work. Evaluation studies have identified special programs that

- increase the number of math and science courses girls take
- reduce girls' stereotypes about people who are good in math and science
- increase girls' interest in and commitment to careers in math, science, and engineering

Skill in recruiting and retaining girls in math and science programs. Since students are not required to take special programs, programs that are successful have learned how to get girls to come and, more importantly, how to keep them coming.

Schools also have much to offer special programs, including

Access to large numbers of girls. While only a small percentage of girls go to special programs, almost all girls go to school.

Ability to institutionalize programs. Special programs will be around only as long as they have grant funds or other "soft" money; however, schools, in one form or another, will be around for a long time.

Ability to integrate effective techniques throughout girls' school years. Special programs tend to be short-term, and then girls go back to the same teachers and schools. Schools can provide girls with consistent, long-term support.

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This series was developed under a grant from the U.S. Department of Education, under the auspices of the Women's Educational Equity Act. However, the opinions expressed herein do not necessarily reflect the position or policy of the Department of Education, and no official endorsement by the Department should be inferred.

Making Changes: Why Bother?

In 1990 the National Science Foundation reported that after increasing for a decade, the number of young women going into science and engineering is at a plateau and, in some fields such as computer science, is actually decreasing.

While girls are taking more advanced math and science classes in high school, with the exception of biology, they tend not to major in science or engineering in college.

While programs to encourage girls in math and science have been successful, most have not addressed issues of race and class. Low-income girls have had access to far fewer programs than have had middle-class girls. Low-income students and students of color are half as likely to take algebra and geometry as are wealthier white students. However, those who do take algebra and geometry in high school are as likely to go to college as are wealthier white students.

Current work force projections indicate that unless more women and minority men are attracted to science, the United States will not have the trained personnel necessary to meet its needs.

Collaborative efforts between schools and those working out of school to help girls in math and science can make a difference. Working together, we can ensure that girls and math become a powerful equation.

To begin:

- Find out what in-school and out-of-school efforts are being made in your community and find the names of contact people. In-school contacts are likely to be found in math and science departments or through curriculum supervisors. Out-of-school contacts may be found anywhere, but local Girls Incorporated sites are good places to start, as are departments of education and of women's studies at local colleges.
- Meet and brainstorm ways to work together. You may start by having out-of-school people come to the school and do some equity-based hands-on science and go on to develop joint programs and training.

Working Together: What Works and What Doesn't

The following seven suggestions, based on evaluation and research, help make collaboration work:

1. Make sure everyone knows the objectives and is in agreement with them. Ideally, everyone should work together to define the objectives.
2. Write and sign letters of agreement that describe what is going to be done and by whom.
3. Plan from the beginning how program activities will be continued once outside funds are spent.
4. Develop partnership teams of in- and out-of-school personnel to work together during training and beyond. School-based teams should include an administrator and more than one teacher.
5. Include extra planning time so people can get to know each other and share their perspectives.
6. Provide opportunities for people working directly with students to design or modify parts of the project.
7. Conduct formative evaluation to see how the program is going. Use the results to make changes as necessary.

Experience has also shown a number of things that should **not** be done:

- **Don't** have out-of-school people work only with students and not with teachers.
- **Don't** do "one shot" training with no follow-up or support for classroom implementation.
- **Don't** blame teachers for things beyond their control.
- **Don't** assume teachers are aware that most current teaching practices discourage girls in math and science.
- **Don't** use the school primarily as a source of students, or use the out-of-school organization primarily as a source of talent or funds, instead of developing an equal partnership.

Working Together: Changing the Classroom

Using the following model, teachers have been able to double the amount of hands-on science they do and to "keep up the good work" over time.

Outside intervention

Trainers are needed who

- are familiar with hands-on activities that build on existing areas of teacher comfort and fit into the current curriculum
- are knowledgeable about gender and race issues in classrooms
- can motivate teachers
- have enough resources to get things going

Science museums can provide good science and math trainers, but be sure trainers have experience working in schools and understand equity areas.

Ongoing administrative support and supervision

The principal or other supervisor *must* stay involved with teachers, seeing what they are doing, asking what they plan to do, and making sure girls are getting an equal share of encouragement and opportunities. If the principal or supervisor stops monitoring, the practice of equitable, hands-on science and math begins to decrease.

Evaluation

Evaluation of program activities, feedback on what is found, and recommendations for improvement are important to keep everyone on track.

On-site role model

Motivation and the will to try new things are important to sustaining change. The teacher who independently continues to successfully try new ideas can serve as a motivator. With a motivator present, teachers are more apt to go beyond what was presented in training to develop their own ideas.

Compensation

If schools are serious about increasing girls' involvement in math and science, they must find a way to reward the teachers who do so successfully.

Making Changes: What Needs to Happen?

Math and science need to become more hands-on.

"School math is sitting in a chair and listening to the teacher, not understanding what they are talking about."

"School science is mostly lecturing and copying from the chalkboard . . ."

Research has indicated that most math and science courses are currently being taught as described above. Many organizations including the National Council of Teachers of Mathematics and the National Science Foundation are making efforts to change this so that students can "actually have fun while [they] are learning."

Evaluation results indicate that both white girls and girls of color will take more math and science courses if they experience math and science as fun and hands-on, and if they learn that when they ask questions, someone will keep working with them until they understand.

Girls need to get "their fair share" of time, attention, leadership, and opportunities.

"Boys are treated as if they are better than girls and more time is spent with them."

Unless specific attention is paid to issues of gender and race, reform efforts become "them that has, gets," and gaps between girls and boys widen rather than narrow. Teachers, counselors, and administrators need to check and recheck to be sure that

- they pay equal attention to girls and boys
- equal numbers of girls lead groups
- all students do hands-on activities
- girls and boys are aware of the importance of math and science in future career decisions
- girls feel comfortable asking questions and are given supportive answers
- girls don't defer to boys and boys don't expect them to

Encouraging Girls in Math and Science uses the latest research to engage families, educators, and the community in the exploration of effective math and science education for female students. Perfect for PTO/PTA meetings, training workshops and inservice, community and resource centers, family information packets, project staff meetings, and administrative meetings.

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Making Changes: Challenging the Stereotypes

Stereotypes about what mathematicians and scientists are like need to be changed.

Most high school girls who are themselves good at math and science see mathematicians and scientists as "nerds," "social outcasts," and "loners." Many also see math and science as "male dominated" and "a man's job."

It doesn't have to be that way. Special programs have been able to change girls' negative attitudes about what scientists and mathematicians are like by providing opportunities for girls to

- get to know women who are working as scientists and engineers and to learn they are not "nerds"
- spend time with other girls who are also very good in math and science and who face some of the same barriers and feelings of isolation
- see for themselves that a social life and science do not have to be incompatible

Such experiences can happen in schools as well as in special programs. Having students get to know and work with women scientists not only provides students with realistic ideas of what scientists actually do, but helps them see that women and science are a good combination!

Resources

The following projects are all examples of successful collaborations whose goals involve increasing the participation of white girls and girls of color in math and science:

Gender/Ethnic Expectations and Student Achievement (GESA). GrayMill Foundation, Rt. 1, Box 45, Earlham, IA 50072 (515)834-2431. The program works with teachers and administrators to increase student achievement through equitable classroom interaction.

Intervention Programs in Math, Science, and Computer Science for Minority and Female Students in Grades Four Through Eight. (Publication CN6736-PJ798-99.) ETS, Princeton, NJ 08541 (609)921-9000. The directory of 163 programs gives information on populations served and activities offered, as well as contact people and addresses.

Operation SMART™. Girls Incorporated, 30 East 33rd St., New York, NY 10016 (212)689-3700. This out-of-school math, science, and technology program provides curriculum and training models for working with girls from elementary school through high school.

Project EQUALS. Lawrence Hall of Science, University of California, Berkeley, CA 94705 (415)642-1823. Working with teachers and community leaders, the project brings fun, hands-on math, science, and computing to white girls and girls and boys of color.

Science Teams. Consortium for Educational Equity, Rutgers University, New Brunswick, NJ 08903 (908)932-2071. Working with middle school teachers, this program combines cooperative learning and hands-on science with an equity orientation.

Southeastern Consortium for Minorities in Engineering (SECME). Georgia Institute of Technology, Atlanta, GA 30332 (404)894-3314. Working with teachers, students, and whole school systems, this program works on improving math instruction and providing opportunities for girls and boys of color.

The research and evaluation results on which this brochure is based are available from Campbell-Kibler Associates, Groton Ridge Heights, Groton, MA 01450.

Other brochures in this series include

"Math, Science, and Your Daughter: What Can Parents Do?"
"Nothing Can Stop Us Now: Designing Effective Programs for Girls in Math, Science, and Engineering"
"What Works and What Doesn't? Ways to Evaluate Programs for Girls in Math, Science, and Engineering"

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